



**Progress Report 2012
(August 7, 2012)**

Introduction

Yakama Nation Fisheries is working throughout the Nation's ceded areas in Central Washington State, applying a combination of habitat restoration and hatchery supplementation or reintroduction to restore mainstem Columbia River and tributary ecosystems with sustainable and harvestable populations of salmon, steelhead and other at-risk species. Our objectives are to: enhance existing stocks, re-introduce extirpated stocks, protect and restore habitat, and operate using a scientifically rigorous process that will foster application of the knowledge gained about hatchery supplementation and habitat restoration throughout the Columbia River Basin. Yakama Nation Fisheries currently has 200 employees working on more than 100 projects. Yakama Nation Fisheries funnels roughly \$30 million of federal funding annually into rural economies in Central Washington in support of salmon restoration and production projects.

The original impetus for these efforts resulted from the landmark fishing disputes of the 1970s, the ensuing legal decisions in *United States versus Washington* and *United States versus Oregon*, and the region's realization that lost natural production needed to be mitigated in upriver areas where these losses primarily occurred. These efforts are identified and supported in the Northwest Power and Conservation Council's (NPCC) Fish and Wildlife Program (FWP), *U.S. v Oregon* Management Plans and Agreements, and the Columbia River Fish Accords.

Hatchery supplementation is envisioned as a means to enhance and sustain the abundance of wild and naturally-spawning populations at levels exceeding the cumulative mortality burden imposed on those populations by habitat degradation and by natural cycles in environmental conditions. A supplementation hatchery is properly operated as an adjunct to the natural production system in a watershed. By integrating the hatchery with a naturally-producing population, high survival rates for the component of the population in the hatchery can raise the average abundance of the total population (hatchery component + naturally-producing component) to a level that compensates for the high mortalities imposed by human development activities and fully seeds the natural environment.

However, it is important to recognize that "rebuilding natural populations will ultimately depend on improving habitat quality and quantity" ([ISRP 2011](#)) of which habitat connectivity is an essential component (Milbrink et al. 2011). Hatchery programs, even "state of the art" integrated supplementation programs designed to

follow all of the best management practices recommended by regional scientific review groups (e.g. Mobrand et al. 2005), do not directly affect any of these habitat parameters which are vital to improving natural productivity. Therefore, Yakama Nation Fisheries is working independently and collaboratively with Subbasin partners through Subbasin Planning and Recovery Boards to implement habitat restoration projects designed to address factors limiting productivity throughout the ceded lands.

This report summarizes Yakama Nation Fisheries activities and documents progress toward salmon recovery throughout the ceded lands. Data and findings presented in this report should be considered preliminary until results are published in the peer-reviewed literature. Additional detail can be accessed through the Yakama Nation Fisheries web site (<http://yakamafish-nsn.gov>).

Yakima River Basin

Habitat Restoration

Yakama Reservation Watersheds Project

The Satus, Toppenish and Ahtanum watersheds are home to approximately half the total spawning abundance—and two of the four distinct populations—of Yakima Subbasin steelhead. Currently, these watersheds are habitat limited for a variety of reasons.

Stream channel, floodplain and vegetation restoration projects addressing habitat related limiting factors (i.e., flow, key habitat quantity, habitat diversity, temperature, sediment load, channel stability) form the core of this project. The ultimate goal of the project is to restore the natural hydrologic function of the watersheds as much as possible without causing an overwhelming burden to economic interests (i.e., timber harvest, agriculture) on the reservation. This in turn will increase steelhead spawning success and juvenile survival to outmigration. In addition to steelhead, restoration work is expected to benefit other anadromous and resident fish species (e.g., coho salmon, chinook salmon, bull trout, and westslope cutthroat trout) and many wildlife species as well.

The project conducts comprehensive watershed restoration activities including (1) headwater wetland rehabilitation; (2) adult and juvenile fish passage restoration; (3) stream channel and riparian area restoration including bringing stream channels back to grade, reconnecting side channels and floodplains, planting native vegetation in conjunction with riparian and range fencing; (4) minimum instream flow implementation and modification of irrigation water sources and uses; along with (5) physical monitoring that includes precipitation, groundwater, discharge from streams,

canals and drains, temperature, water quality, fish habitat structure and quality according to accepted protocols; and (6) biological monitoring including spawning ground surveys, snorkel surveys and smolt trapping.

Upper Yakima and Naches Subbasin Restoration Activities

Objectives include habitat protection and restoration in the most productive reaches of the Yakima Subbasin. Major accomplishments to date include protection of 1,812 acres of floodplain habitat, reconnection and screening of over 50 miles of tributary habitat, substantial water savings through irrigation improvements, and instream and floodplain restoration on the mainstem Yakima River and tributaries. Substantial restoration has been completed in the Taneum and Swauk watersheds with more planned for the coming year. Large woody material has been placed, step pools and engineered jams have been constructed in middle Swauk. The project continues to promote relocating a portion of a USFS road in the little Naches watershed. In the future, the project will work within available funding and personnel capacity to design and implement the highest priority restoration and protection projects for the benefit of anadromous salmonids.

In addition to these Yakama Nation Fisheries habitat protection and restoration activities, the Yakama Nation is also working with subbasin partners to implement numerous Salmon Recovery Funding Board projects (see Yakima Basin Fish and Wildlife Recovery Board [summary](#)).

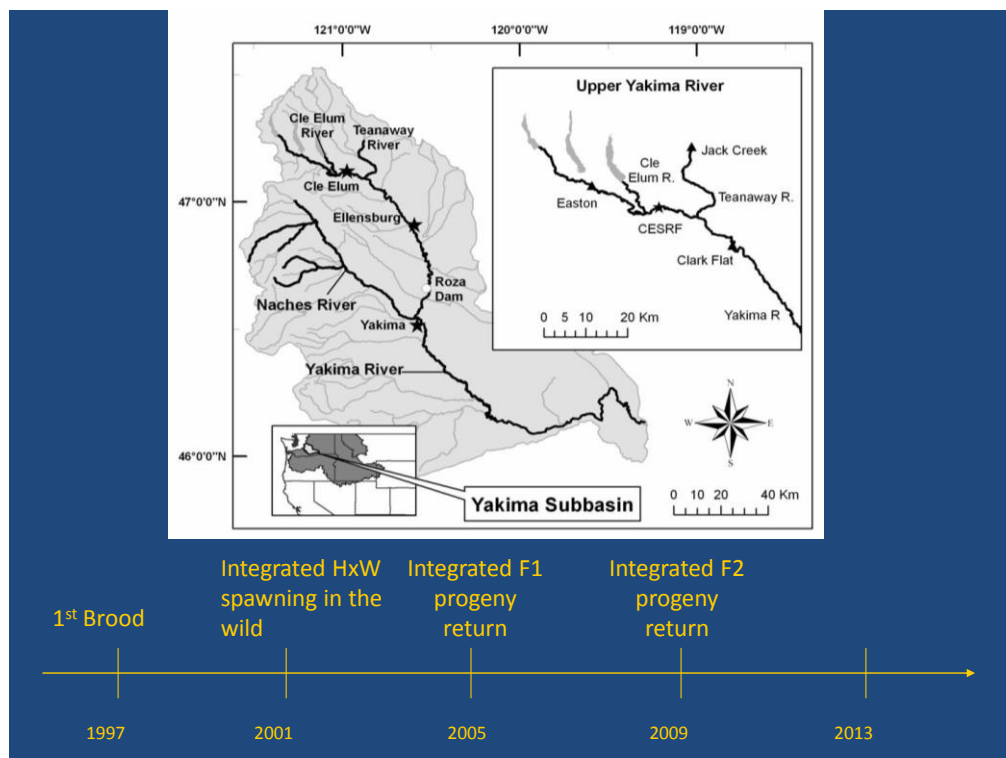
Spring Chinook Supplementation and Research

This project was originally conceived in 1982 as a mitigation facility, but the unique features of the Yakima River Basin, its spring Chinook populations and existing infrastructure prompted the Yakama Nation and regional partners to expand the project to include research to address critical uncertainties relating to hatchery production throughout the Columbia Basin (see [Columbia River Basin Research Plan](#)). The spring Chinook (*O. tshawytscha*) salmon hatchery program at the Cle Elum Supplementation and Research Facility (CESRF) near Cle Elum on the upper Yakima River (river kilometer 297, measuring from the confluence with the Columbia River; Figure 1) began in 1997. The program is a collaborative effort between the Yakama Nation, Washington Department of Fish and Wildlife, Bonneville Power Administration, U.S. Bureau of Reclamation, NOAA Fisheries, and others.

The CESRF spring Chinook program is a supplementation effort targeting the upper Yakima River population and is designed to test whether artificial propagation can be used to increase natural production and harvest opportunities while limiting ecological and genetic impacts (RASP 1992). It is an integrated hatchery program (Mobrand et

al. 2005) because only natural-origin broodstock are used and returning hatchery-origin adults are allowed to spawn in the wild. The program employs “best practice” hatchery management principles (see Cuenco et al. 1993, Mobrand et al. 2005) including reduced pond densities, strict disease management protocols, random broodstock selection, and factorial mating (Busack and Knudsen 2007) to maximize effective population size. Fish are reared at the central facility, but released from three acclimation sites located near the central facility at: Easton approximately 25km upstream of the central facility, Clark Flat about 25km downstream of the central facility, and Jack Creek about 12km upstream from the Teanaway River’s confluence with the Yakima River. The CESRF collected its first spring Chinook brood stock in 1997, released its first fish in 1999, and age-4 adults have been returning since 2001. The first generation of offspring of CESRF and wild fish spawning in the wild returned as adults in 2005. The program uses the adjacent, unsupplemented Naches River population as an environmental and wild control system.

Figure 1. Map of the Yakima River Basin, Cle Elum Supplementation and Research Facility (CESRF) locations, and timeline of the spring Chinook supplementation program.



Hatchery Critical Uncertainty 1. What is the cost to natural populations caused by interactions (e.g., competition and predation) with hatchery-origin fish?

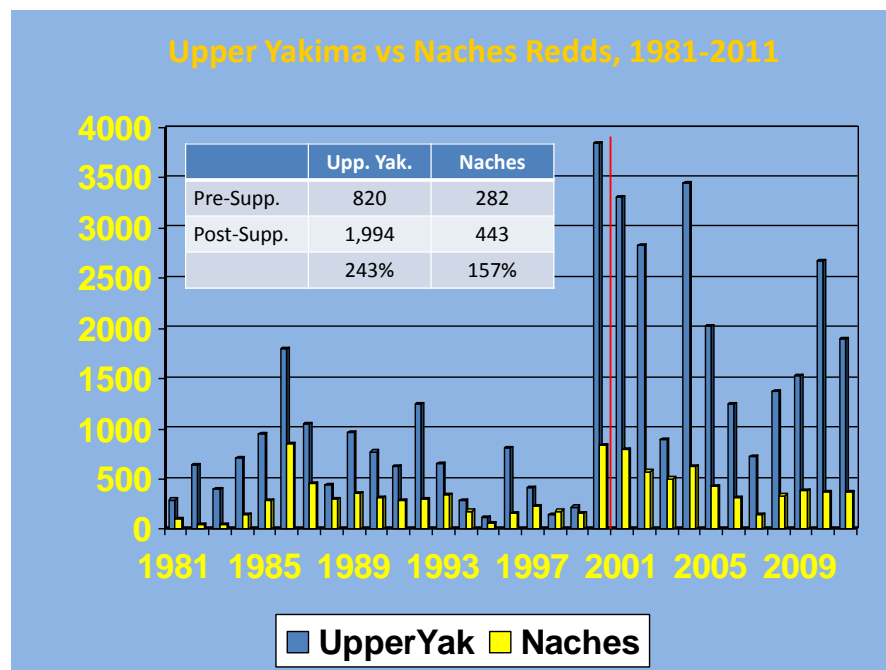
Hatchery Critical Uncertainty 7. What effect do hatchery fish have on other species in the freshwater environment?

Findings: We have detected generally small, but significant differences in juvenile traits between hatchery- and natural-origin fish including: size of progeny (Knudsen et al. 2008), agonistic competitive behavior (Pearsons et al. 2007), predator avoidance (Fritts et al. 2007), and incidence of precocious maturation (Beckman et al. 2008; Larsen et al. 2004, 2006; Pearsons et al. 2009). Ecological impacts to valued non-target taxa were generally within containment objectives, or impacts that were outside of containment objectives were not caused by supplementation activities (Pearsons and Temple 2007). Changes to rainbow trout abundance and biomass were observed in a tributary watershed where hatchery-origin fish were released, but the trout may have been simply displaced to other areas (Pearsons and Temple 2010).

Hatchery Critical Uncertainty 3. What is the magnitude of any demographic benefit to the production of natural-origin juveniles and adults from the natural spawning of hatchery-origin supplementation adults?

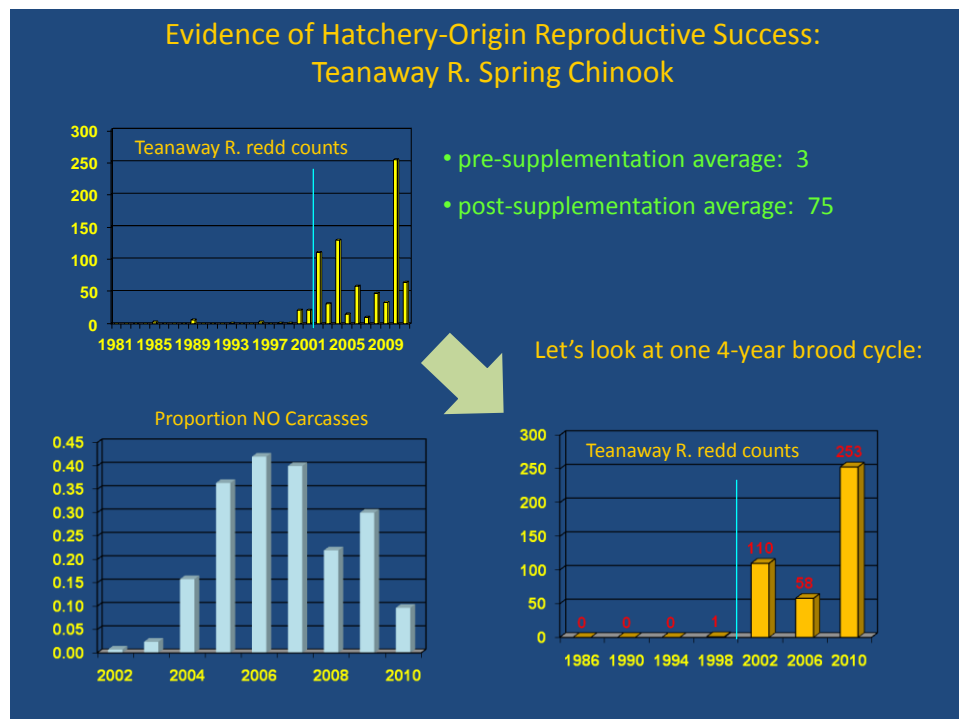
Findings: Supplementation has increased redd abundance in the Upper Yakima relative to the control system. Figure 2 presents Before-After Control-Impact (BACI) redd count data for the Upper Yakima and Naches rivers. Redd counts in the post-supplementation period (2001-2011) have increased significantly in both the supplemented Upper Yakima and Naches control systems relative to the pre-supplementation period (1981-2000), but the average increase in redd counts in the upper Yakima (243%; $P=0.001$) was 86% greater than that observed in the Naches system (157%; $P=0.048$).

Figure 2. Spring Chinook redd counts in the supplemented Upper Yakima (blue bar) relative to the unsupplemented Naches (control; yellow bar) for the pre- (1981-2000) and post-supplementation (2001-2011) periods.



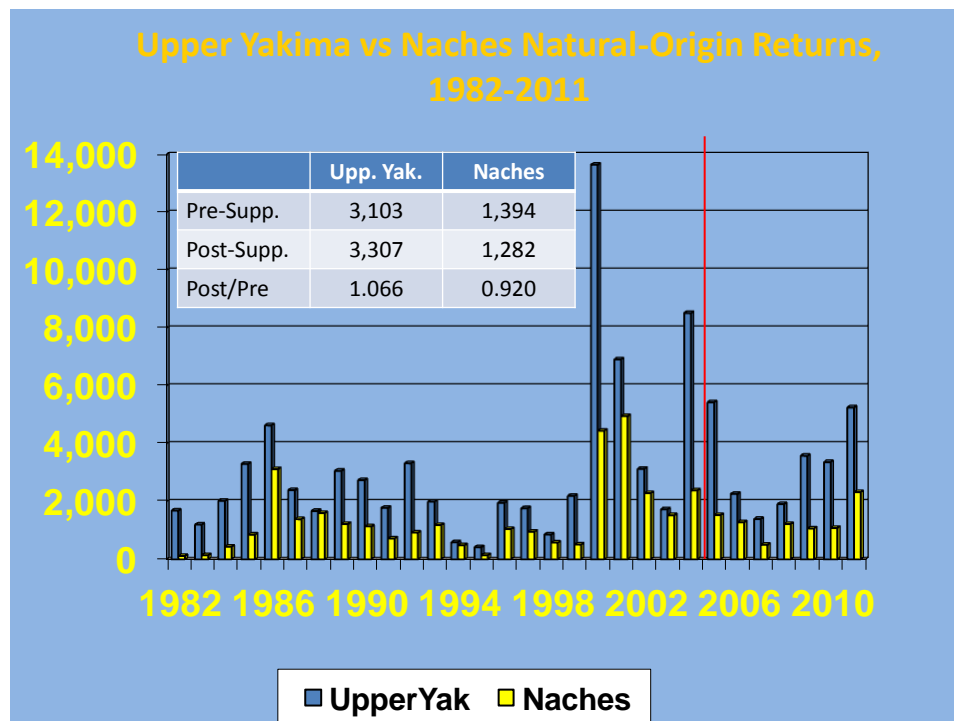
Spatial distribution of spawners has also increased as a result of acclimation site location, salmon homing fidelity and more fully seeding preferred spawning habitats (Dittman et al. 2010). Redd surveys in the Teanaway River conducted annually by Yakama Nation staff since 1981 demonstrate the benefits of reintroducing salmonids into underutilized habitat (Figure 3). The Jack Creek acclimation site began releasing CESRF spring chinook in 2000, with the first age-4 females returning from these releases in 2002. Redd counts in this tributary have increased from a pre-supplementation average of 3 redds per year to a post supplementation average of 75 redds per year. The proportion of natural-origin carcasses increased from less than one percent in 2002 (when CESRF fish first returned to the natural spawning grounds) to 42% in 2006 when the progeny of the 110 redds produced in 2002 (virtually 100% of which were produced by CESRF-origin fish) returned. These data clearly indicate that naturally-spawning CESRF spring Chinook were successful in returning natural-origin adults back to the Teanaway River.

Figure 3. Teanaway River Spring Chinook redd counts, 1981-2011 (blue lines denote pre- and post-supplementation periods) and the proportion of natural-origin (NO) carcasses observed in intensive spawning ground surveys, 2002-2010.



Supplementation has not increased natural-origin returns in the Upper Yakima relative to the control system. Figure 4 presents Before-After Control-Impact (BACI) natural-origin return data for the Upper Yakima and Naches rivers. Natural-origin returns in the post-supplementation period (2005-2011) have not changed significantly in either the supplemented Upper Yakima or Naches control systems relative to the pre-supplementation period (1982-2004). However, the mean natural-origin return in the post-supplementation period increased in the upper Yakima (1.07; $P=0.86$) and decreased in the Naches system (0.92; $P=0.83$) relative to the pre-supplementation period. It may be that the post-supplementation time period is not yet long enough to detect a significant change in this natural production parameter.

Figure 4. Natural-Origin returns of Spring Chinook in the supplemented Upper Yakima (blue bar) relative to the unsupplemented Naches (control; yellow bar) for the pre- (1982-2004) and post-supplementation (2005-2011) periods.



Regarding other demographic parameters, we have detected significant differences in hatchery- and natural-origin fish after only one generation of hatchery exposure for the following variables measured on adults: age composition, size-at-age, sex ratio, spawning timing, fecundity, egg weight, and adult morphology at spawning (Busack et al. 2007; Knudsen et al. 2006, 2008). Most of the differences have been 10% or less. Semi-natural rearing did not result in significant increases in survival of hatchery fish

(Fast et al. 2008). Growth manipulations in the hatchery demonstrated the ability to reduce the number of precocious males produced, however post-release survival of treated fish may be lower than conventionally reared fish due to reduced size-at-release (Larsen et al. 2006; Pearsons et al. 2009). Smolt-to-adult recruit survival (SARS) on observed fish tagged with passive integrated transponder (PIT) tags was significantly lower than that of non-PIT-tagged fish because of PIT tag loss and tag-induced mortality, resulting in an average underestimate of SARS of 25.0% (Knudsen et al. 2009).

Yakama Nation Fisheries coho (*O. kisutch*) programs are providing additional information relative to this critical uncertainty.

Hatchery Critical Uncertainty 4. What are the range, magnitude, and rates of change of natural spawning fitness of integrated (supplemented) populations?

Findings: Experiments were conducted in an artificial spawning channel at the CESRF from 2000-2004. No differences were detected in the egg deposition rates of wild and hatchery origin females, but pedigree assignments based on microsatellite DNA showed that the eggs deposited by wild females survived to the fry stage at a 5.6% higher rate than those spawned by hatchery-origin females (Schroder et al. 2008). Behavior and breeding success of wild and hatchery-origin males were found to be comparable (Schroder et al. 2010).

Summer and Fall Run Chinook

Yakama Nation Fisheries is presently studying the release of over 2.0 million Upriver Bright fall Chinook (*O. tshawytscha*) smolts annually from the Prosser Hatchery. These fish are a combination of in-basin production from brood stock collected in the vicinity of Prosser Dam plus out-of-basin Priest Rapids stock fish reared at Little White National Fish Hatchery and moved to Prosser Hatchery for final rearing and release. These fish contributed to the improved returns of fall Chinook to the Columbia River in recent years. This project is investigating ways to improve the productivity of fish released from Prosser Hatchery and to improve in-basin natural production of fall Chinook. For example, rearing conditions designed to accelerate smoltification of Yakima Basin fall Chinook have resulted in smolt-to-smolt survival indices that exceeded those of conventionally reared fall Chinook in five of the six years for which results are available.

The Yakima Subbasin Summer and Fall Run Chinook and Coho Salmon Hatchery Master Plan (Yakama Nation 2012) proposes to: 1) transition out-of-basin brood source releases from the Little White Salmon National Fish Hatchery to Priest Rapids

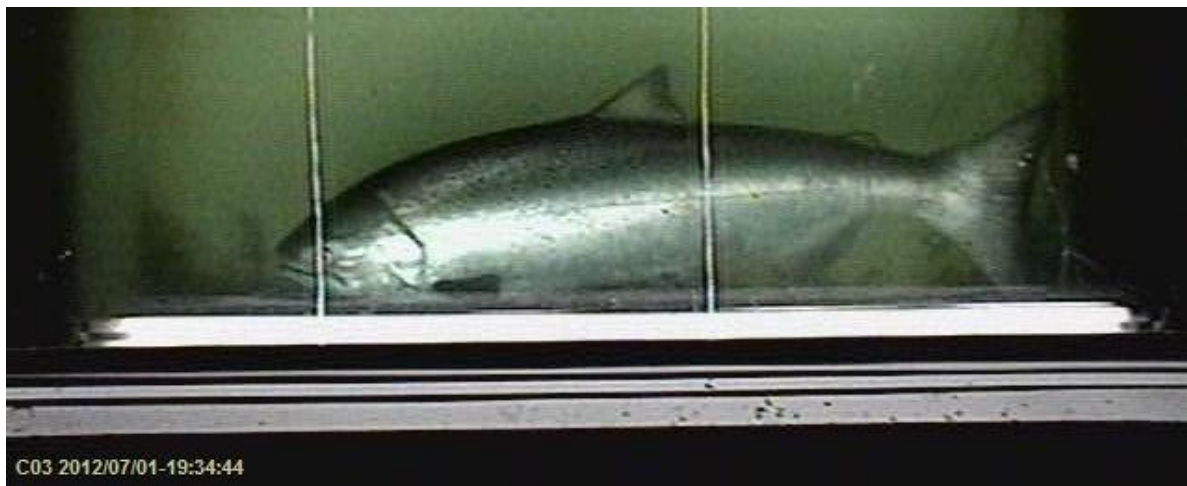
or local brood source and release these fish from acclimation sites in the lower Yakima River near or below Horn Rapids Dam, 2) continue development of an integrated production program above Prosser Dam using locally collected brood stock, 3) re-establish a summer-run component using an appropriate founder stock, and 4) upgrade existing brood collection, production and acclimation facilities to accommodate changes in production strategies. The total number of fish released would remain similar to existing levels.

Summer run Chinook were extirpated from the Yakima Basin by 1970. In an effort to re-establish this run, the program began releases of Wells Hatchery summer-run Chinook in the Yakima River Basin in 2009. The major objectives of this effort are:

- 1) Develop a naturally spawning adult population in the Yakima River between Sunnyside Dam and Roza Dam, and in the lower Naches River from the mouth to the Tieton River, and,
- 2) Increase the number of natural-origin returning summer-run adults in the lower Columbia, Zone 6, and the lower Yakima River contributing to harvest augmentation for both the tribal and sports fishery.

In the initial years of this re-introduction effort, we are releasing a combination of yearling and sub-yearling smolts to improve survival to adult return. When sufficient numbers of adults are returning we will collect brood stock for the program locally at Prosser or Sunnyside Dams. We are already seeing results from this re-introduction effort with a few hundred adult summer run Chinook expected to return above Prosser Dam in 2012 based on the number of PIT detections of 2009, 2010, and 2011 releases observed at Bonneville, McNary, and Prosser Dams through July 17, 2012.

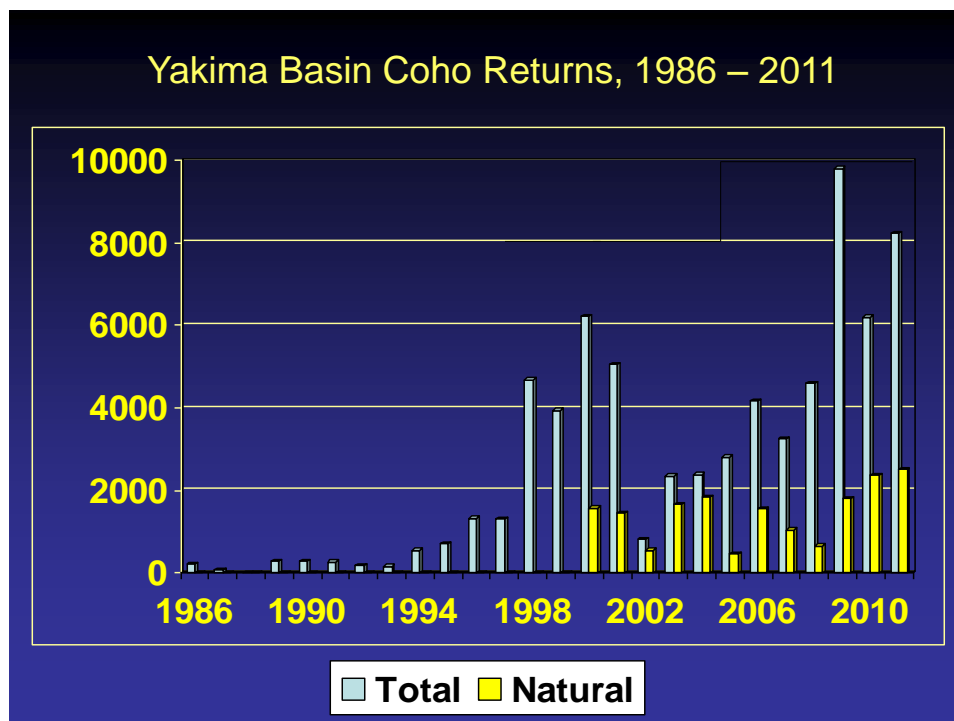
Figure 5. One of the first adult summer-run Chinook to pass upstream at Prosser Dam in over 40 years. From PIT release and detection data, this is a 3-ocean fish returning from the 2009 subyearling release and passing Prosser on July 1, 2012.



Coho

Yakama Nation Fisheries is presently studying the release of over 1.0 million coho smolts annually from acclimation sites in the Naches and Upper Yakima subbasins. These fish are a combination of in-basin production from brood stock collected in the vicinity of Prosser Dam plus out-of-basin stock generally reared at Willard or Eagle Creek National Fish Hatcheries and moved to the Yakima Subbasin for final rearing and release. Monitoring of these efforts to re-introduce a sustainable, naturally spawning coho population in the Yakima Basin have indicated that adult coho returns averaged about 3,900 fish from 1997-2011 (an order of magnitude greater than the average for years prior to the project) including estimated returns of wild/natural coho averaging over 1,400 fish since 2001 (Figure 6). Coho re-introduction research has demonstrated that hatchery-origin coho, with a legacy of as many as 10 to 30 generations of hatchery-influence, can reestablish a naturalized population after as few as 3 to 5 generations of outplanting in the wild (Bosch et al. 2007). The project is working to further develop a locally adapted broodstock and to establish specific release sites and strategies that optimize natural reproduction and survival.

Figure 6. Total (blue bar) and natural-origin (yellow bar) returns of Coho to the Yakima River Basin, 1986-2011.



Sockeye

Prior to 2008, returns of sockeye (*O. nerka*) salmon to the upper Columbia Basin numbered 50,000 or fewer in 14 of 22 years. Of the historic sockeye nursery lake habitat in the Upper Columbia, only about 4% is presently utilized with only two (Wenatchee and Osoyoos) of 12 historic nursery lakes presently producing fish. Four nursery lakes in the Yakima River Basin, which historically produced an estimated annual return of about 200,000 sockeye, were removed from production in the early 1900s when irrigation storage dams were constructed without passage. Work conducted by the National Marine Fisheries Service from 1987 to 1993 in Lake Cle Elum returned from 4 to 20 sockeye adults to the base of Cle Elum Dam demonstrating that sockeye restoration was feasible with sufficient passage modifications. In 1994 the Yakima River Basin Water Enhancement Project Act was passed providing for increased storage capacity in Cle Elum reservoir including provisions for developing fish passage alternatives. In 2006-2007, the Yakama Nation and the Bureau of Reclamation conducted additional feasibility work using a temporary juvenile passage flume and coho salmon as surrogates. Over 25% of the coho smolts released into Lake Cle Elum successfully migrated using the flume and 1.5% of the known 2006 outmigrants returned as adults to Prosser Dam in 2007. Based on the success of this prior work, the Yakama Nation negotiated an agreement with the *U.S. v Oregon* parties to transplant adult sockeye from Priest Rapids Dam to Lake Cle Elum contingent on run size. One thousand adult sockeye were transplanted in the summer of 2009, 2,500 in 2010, 4,500 in 2011, and 10,000 in 2012. The sockeye successfully spawned in tributaries above the Lake in all years becoming the first sockeye to spawn in the Yakima Basin in over 100 years (Figure 7). Juveniles from the 2009 brood were observed migrating downstream at Roza and Prosser Dams in 2011 (Figure 8). Preliminary data from trapping operations at Prosser indicated a 2011 smolt outmigration of approximately 80,000 sockeye. The Yakama Nation intends to continue this effort, and with restoration of adult passage to Lake Cle Elum, the region could see a self-sustaining sockeye population returning to the Basin within 25 years.



Figure 7. Adult Sockeye spawning in the Cle Elum R. near Cooper Lake Bridge for the first time in over 100 years.



Figure 8. A brood year 2009 wild Sockeye smolt migrating downstream at Roza Dam, May 10, 2011. Photo courtesy of Gordon King, Yakima Herald-Republic.

Steelhead Kelt Reconditioning

Columbia River steelhead (*O. mykiss*) are iteroparous (able to spawn multiple times). However, major dams affect their survival as post-spawned steelhead (kelts) attempt to migrate downstream for a return trip to the ocean (Wertheimer and Evans 2005).

Therefore, a novel approach to effectively increase abundance and productivity of steelhead populations is to capitalize on their inherent iteroparity by artificially reconditioning kelts. Reconditioning is the practice of capturing, holding, and feeding post-spawned salmon or steelhead in an artificial rearing environment for the purpose of regeneration of gonads for repeat spawning.

Yakama Nation Fisheries has been reconditioning steelhead kelts at the Prosser Hatchery since 2001. From 2001 to 2011 we evaluated the characteristics of Yakima River steelhead populations and reconditioned steelhead kelts (Hatch et al. 2012, in peer review). We captured about 27% of annually returning wild steelhead as downstream migrating kelts at an irrigation diversion facility. Captured kelts were reared for 4.5-10 months in an artificial environment, treated for diseases and parasites, and fed both krill and pellets. Surviving reconditioned fish were released into the Yakima River coincident with the upstream 'maiden' steelhead migration. Reconditioned steelhead kelts were predominantly (>92%) female. Survival to release ranged from 20-62% and averaged 38% with reconditioned kelts showing positive changes in fork length, weight, and Fulton's K condition factor. Kelt condition and color at time of collection was correlated with survival. Migration timing of reconditioned kelts was correlated with run timing of upstream maiden migrants. Given adequate collection opportunity the empirical results we observed demonstrate the potential of steelhead kelt reconditioning to provide recovery benefits for imperiled wild steelhead populations in the Columbia River Basin.

Steelhead populations in the Yakima River Basin may well be responding to the combined results of this innovative project and the habitat restoration work described earlier in this report. Wild steelhead counts at Prosser Dam have exceeded 6,000 fish every year since 2009. This compares to an annual average of fewer than 2,000 fish from 1983-2008 (Figure 9). Counts at Roza Dam in the Upper Yakima Basin exceeded 400 steelhead for the 2011-12 return year, likely the highest count recorded since the dam was constructed in 1939 (Figure 9).

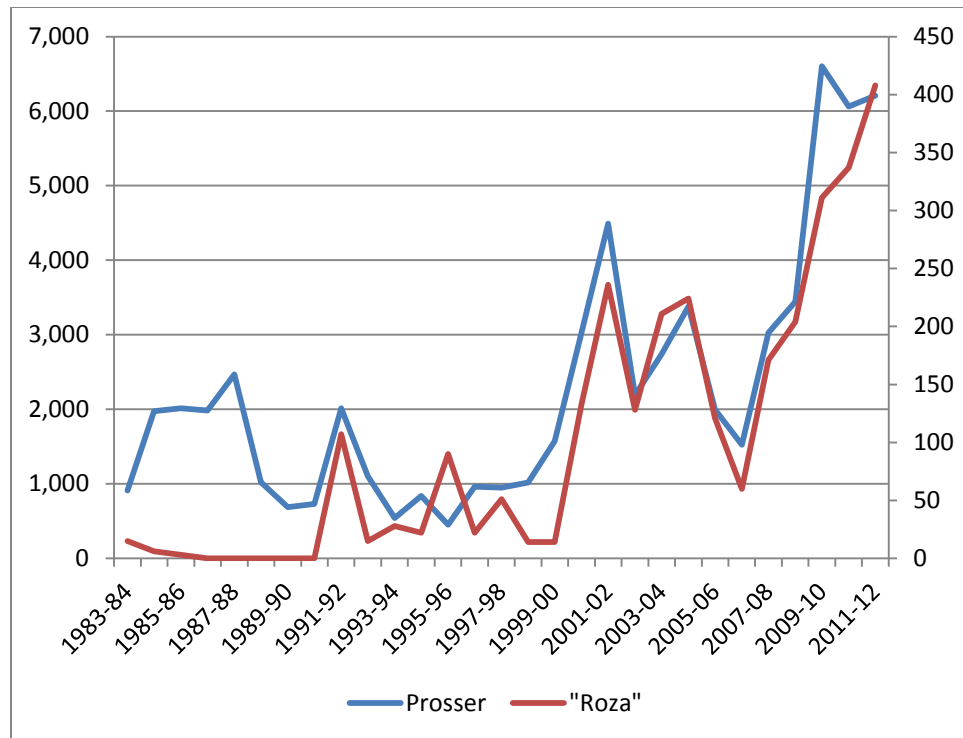


Figure 9. Wild steelhead abundance at Prosser (blue, left axis) and Roza (red, right axis) dams for adult return years (July 1 to June 30) 1983-84 to present.

Sturgeon

The development of dams along the Columbia River Basin has had negative impacts on white sturgeon (*Acipenser transmontanus*) populations. White sturgeon in the middle and upper Columbia River now reside in human-controlled and impounded reservoirs between dams. While these populations are able to reproduce, the juvenile or larval fish have a very poor survival rate in the natural river, which leads to population declines. Some researchers believe this is likely due to regulation of river flows; flooding of historical critical spawning and rearing habitats; and increased numbers of native and non-native predators due to habitat alteration, introduction of exotic species, and increased pollution.

To address these issues, Yakama Nation Fisheries created a sturgeon recovery program on 15 acres of Yakama Nation land along Marion Drain near Harrah, Washington. The program is using artificial culturing techniques and broodstock collected from sturgeon at several locations to raise about 40,000 sturgeon at a time for release into various areas throughout the mid-Columbia River. The first release from the program occurred in April of 2011 with over 9,000 ten-month-old juveniles released into the mid-Columbia River near traditional Wanapum fishing areas.

Klickitat River Basin

Habitat Restoration

Klickitat Watershed Enhancement

This project works to restore, enhance, and protect watershed function within the Klickitat subbasin. Project work emphasizes restoration and protection in watersheds and reaches that support native salmonid stocks, particularly steelhead (*Oncorhynchus mykiss*; listed as "Threatened" within the Mid-Columbia ESU), spring Chinook (*O. tshawytscha*) salmon, and bull trout (*Salvelinus confluentus*; ESA "Threatened"). Restoration activities are aimed at restoring stream processes by removing or mitigating watershed perturbances and improving habitat conditions and water quality. Watershed and habitat improvements also benefit fall Chinook (*O. tshawytscha*) and coho (*O. kisutch*) salmon, resident rainbow trout, and cutthroat trout (*O. clarki*) and enhance habitat for many terrestrial and amphibian wildlife species. Protection activities compliment restoration efforts within the subbasin by securing refugia and preventing degradation. Since 90% of the off-reservation project area is in private ownership, maximum effectiveness is accomplished via cooperation with state, federal, tribal, and private entities.

The overall goal of the project is to restore watershed health to aid recovery of salmonid stocks in the Klickitat subbasin. There are three sub-goals:

- Assess watershed and habitat conditions to prioritize sites for restoration activities. This involves data collection, compilation, and review of existing as well as historic habitat and watershed conditions. Identification and filling of data gaps is also a component of the project.
- Protect, restore, and enhance priority watersheds and reaches to increase riparian, wetland, and stream habitat quality. In-situ and watershed-scale restoration activities mitigate or resolve conflicting historic, present, and/or future land-uses. Protect areas of existing high-quality habitat condition and prevent further deterioration of degraded habitats. Restore areas of degraded stream channel and/or habitat condition.
- Monitor watershed conditions to assess trends and effectiveness of restoration activities. Monitoring is a critical component to evaluating project success and guiding adaptive practices. Site-specific and basin-wide spatial scales are addressed. This project augments Klickitat Basin monitoring and evaluation activities by assisting data collection and providing quality control and analysis of channel morphology, streamflow, temperature, habitat, and channel substrate data.

Hatchery Reform

The Klickitat Hatchery began operations in 1952 (construction was not complete until 1954). At that time, the science and art of artificial production was relatively rudimentary. Within the past 50 years, scientific inquiry has lead to new thinking about how and why to engage in artificial production. The hatchery was previously operated by the Washington Department of Fish and Wildlife (WDFW). The ownership and operation of the hatchery, as well as Lyle Falls and Castile Falls fishways, was transferred to the Yakama Nation in December 2005. The Yakama Nation is working diligently to upgrade facilities and hatchery programs to increase the quality of fish produced, improve the overall ecology of the Klickitat River system, and ensure that returning adults are compatible with restoration goals for the Klickitat Subbasin.

Specifically, the Yakama Nation is proposing program enhancements that have as their primary goal an increase in the number and distribution of steelhead and spring Chinook within the Klickitat Subbasin while maintaining or increasing present harvest of all species including fall Chinook and coho. In addition, we are implementing habitat improvements that are expected to benefit listed bull trout, lamprey, and other non-listed species. Ultimately, we seek to ensure an adequate and sustainable supply of anadromous fish to satisfy ceremonial, subsistence, commercial, and recreational needs in the Klickitat Subbasin for many years to come.

Wenatchee, Entiat, and Methow River Basins

Coho Restoration

By the end of the 20th century, indigenous natural coho salmon no longer occupied the mid- and upper-Columbia river basins. Columbia River coho salmon populations were decimated in the early 1900s. For several reasons, including the construction and operation of mainstem Columbia River hydropower projects, habitat degradation, release locations, harvest management, hatchery practices, and genetic guidelines, self-sustaining coho populations were not re-established in mid-Columbia basins. Conditions and practices have changed, and some of the local habitat causes of coho depletion have been corrected, although work is still needed. The Yakama Nation's long-term vision for coho reintroduction in these ceded-area tributaries is: To re-establish naturally spawning coho populations in mid-Columbia tributaries to biologically sustainable levels which provide significant harvest in most years.

Studies of the feasibility of reintroducing coho in the Wenatchee and Methow subbasins began in 1996 and demonstrated that the vision of an optimistic future held

by Yakama Nation (YN) and Washington Department of Fish and Wildlife (WDFW) was possible. These feasibility studies successfully determined that a broodstock can be developed from lower Columbia River coho stocks whose progeny can survive in increasing numbers to return as adults to the mid-Columbia region. We were also successful in initiating natural reproduction in areas of low risk to sensitive species and in other select areas. We investigated risks and interactions with sensitive species and addressed related critical uncertainties.

Just 15 years after the Yakama Nation started mass-producing coho in hatcheries and releasing them from ponds along the Wenatchee and Methow rivers, more of the late-spawning salmon are returning to mid-Columbia rivers and streams than has been observed in at least 78 years. In 2011, over 30,000 adult coho swam up the fish ladders at Rock Island Dam, nearly a third more than the last big run in 2009 and far surpassing the single-to-triple digit annual returns common prior to 2000 (Figure 10).

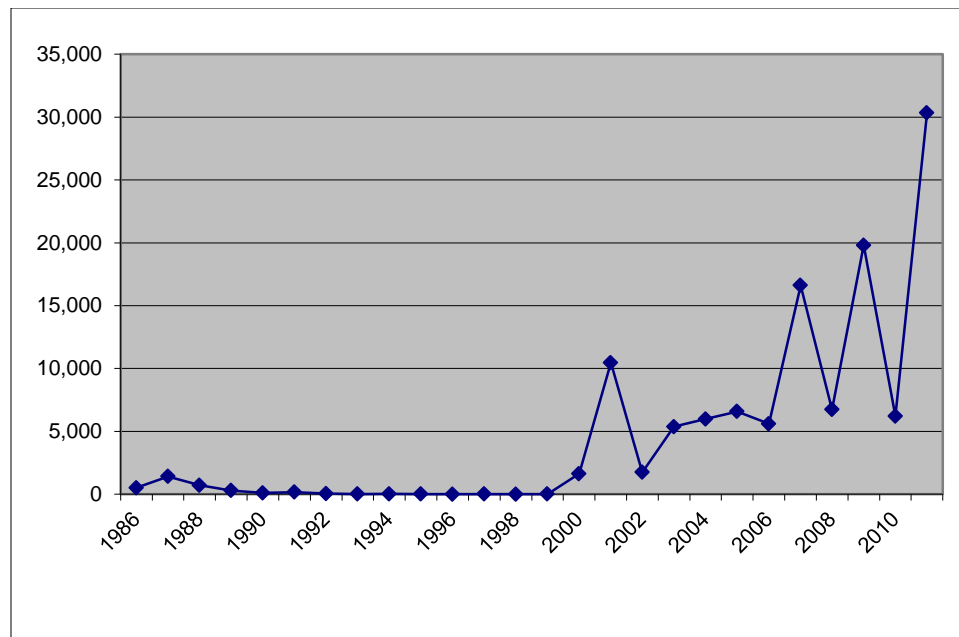


Figure 10. Counts of adult coho at Rock Island Dam, 1986-present.

White Salmon River Basin

Condit Dam Removal

The Yakama Nation entered into discussions with PacifiCorp (owner and operator of Condit Dam) in the 1980s to explore options for fish passage pursuant to relicensing of the project by the Federal Energy Regulatory Commission (FERC). In 1997, PacifiCorp, the Yakama Nation, and the Columbia River Inter-Tribal Fish Commission (CRITFC) entered into a partnership to explore the less expensive

passage alternative of dam removal. A settlement agreement between PacifiCorp, the Tribes, fishery managers, and other interested parties was reached in 1999. The agreement included funding for dam removal, upstream mitigation, and sediment management. After a decade of planning and environmental review, Condit Dam was breached in the fall of 2011. In July 2012, steelhead and spring Chinook salmon were sighted jumping at Husum Falls (river mile 7.6) and BZ Falls (river mile 12.4) marking the first adult salmon to return to upstream spawning grounds in the White Salmon River since Condit Dam was built in 1913.

Yakama Nation Ceded Lands Lamprey Evaluation and Restoration

The goal of the lamprey restoration project is to restore natural production of Pacific lamprey (*Lampetra tridentata*) in the Yakama Nation ceded lands of the Wind, White Salmon, Klickitat, Yakima, Methow, and Entiat rivers and streams. Very little information exists about lamprey abundance and distribution throughout the Ceded lands and essentially no information has been collected concerning known or potential limiting factors. One of the primary and over-arching objectives in the early phases of this project is to survey key habitats and collect baseline information that will be used to develop a long-term restoration strategy. Other key objectives within this time frame will be to evaluate potential artificial propagation and translocation of adult lampreys. These latter objectives would be used as tools to help jump start natural production in selected watersheds.

Initially, the Pacific Lamprey program will focus efforts in program development, regional coordination and initiating surveys in key subbasins habitat for lamprey abundance, distribution and potential primary limiting factors. Due to the lack of lamprey information and the rapidly increasing interest in understanding lamprey status and developing restoration strategies, we will be developing a foundation for a long-term Yakama lamprey program that is well coordinated with other regional interests and entities. Additionally, we will begin habitat surveys and establish a field crew. The long-term objectives and primary focus for this crew are as follows:

- Consolidate and summarize existing databases / information related to Pacific lamprey distribution and abundance within the Yakama Nation Ceded lands.
- Identify lamprey adult and juvenile migration characteristics.
- Identify current habitat strongholds for ammocoete rearing. Quantify and index relative densities of ammocoetes.
- Describe known and / or potential factors that contribute to relatively strong or weak ammocoete production in key (or index) watersheds.
- Describe key habitat characteristics that may contribute or are related to juvenile growth and productivity.

- Measure ammocoete lengths and correlate, if possible age class and annual productivity.
- Identify the key limiting factors that prevent juveniles from successfully hatching, staging and achieving high levels of productivity in preferred habitats.
- Identify key areas where adults hold and/or spawn. Identify environmental / physiological conditions that trigger spawning to occur.
- Describe key habitat characteristics that may contribute or are related to adult holding and/or spawning.
- Identify the key limiting factors that prevent adults from successfully migrating and/or spawning.
- Identify known and suspected passage barriers to adult lamprey migration.
- Identify actions that can be taken to restore or enhance adult holding and spawning.

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